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Technology Is Essential To Arms Verification

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WASHINGTON

A HUNDRED MILES above central Asia, an American satellite suddenly switches into operation. Although it is the dead of night, the spacecraft's camera takes hundreds of photographs of a suspicious construction site near a Soviet intercontinental ballistic missile complex. Minutes later, as the satellite passes over Australia, the infrared photos are transmitted to an American-operated ground station and then relayed to the Central Intelligence Agency in Langley, Va.

Examining the heat-sensitive images with the aid of computers using photo enhancement techniques developed in planetary exploration, C.I.A. analysts quickly note that the ground temperature of the construction site is substantially warmer than the surrounding terrain. The evidence appears conclusive: The Russians have secretly begun building an underground silo in which to house a new, multiwarhead missile.

Only a few years ago, virtually nothing was known about the massive American effort to exploit new technology to keep track of Russian military developments. But now, in the midst of the Senate debate over the new strategic arms treaty, the public is finally learning about the array of systems that the United States, over the last two decades, has used to monitor the expansion of the Soviet strategic arsenal.

The systems have given the American intelligence community an unsurpassed capacity to peel away the layers of secrecy that have traditionally surrounded the Soviet Union's military establishment. But whether these so-called "national technical means of verification" will enable the United States to detect possible efforts by Moscow to circumvent the new arms accord is another question. Unless the Carter Administration can satisfy skeptical senators on this point, the treaty will not win ratification later this year.

The American arsenal for verifying the treaty consists of three principal elements:

Satellites. The best known orbiting systems used to monitor Soviet arms programs are photo reconnaissance satellites which provide complete coverage of the Soviet Union at regular intervals. Using precision-tooled, high-resolution lenses, a new generation of photo satellites, it is reported, is capable of making a clear photograph of a one-foot object from an altitude of 100 miles. Indeed, one intelligence official, in private, said that American photo-interpreters are occasionally able to make out the license-plate numbers on Soviet automobiles on images sent from space.

Although the United States has deployed photo satellites for over 15 years, until recently, the film taken by the systems had to be ejected by parachute and picked up by aircraft at designated drop-zones. However, a new satellite, known as the Keyhole-II, is able to transmit electronically nearly instantaneous images to ground stations located around the world.

Ground Stations. Although satellites can be used to find and count Soviet missiles and bombers, the United States must rely on a series of ground-based, electronic intelligence stations to collect data on new Soviet weapons. Some stations are situated near the Southwestern Soviet border and are designed to monitor the early phases of missile tests launched from the main Russian testing complex at Tyuratam. Other stations are located in the Far East and Alaska, where they watch the final phases of Soviet tests into the Pacific Ocean and count the number of separate nuclear warheads ejected by each type of missile.

Until early this year, the C.I.A. maintained two large antennas in northern Iran which were used to intercept radio signals broadcast by missiles during the first minute or so of test launches from Turatam. The signals, known as telemetry, provided data on key missile characteristics, such as the size, payload and fuel consumption of new rockets.

Although this information is judged to be vital to verifying provisions in the new arms treaty restricting the modernization of new and existing missiles, the C.I.A. was forced to abandon the Iranian stations in the wake of the revolution there.

Ships and Aircraft. The loss of the Iranian sites has led the Administration to seek other means of gathering the missile telemetry. Although American stations in Turkey are too far away to pick up line-of-sight radio broadcasts, a new generation of "over-the-horizon" radars, which bounce signals off the ionisphere, are still able to pick up the trajectory of experimental Soviet missiles.

Meanwhile, American ships equipped with sensitive listening gear similar to the Iranian sites patrol the North Atlantic, where they collect telemetry broadcast by new Soviet submarine-launched missiles tested in the White Sea, northeast of Finland.

But to fully compensate for the Iranian stations, the Administration is reconfiguring the 25-year-old U-2 reconnaissance plane to pick up missile telemetry. Flying at an altitude of 100,000 feet over Turkey and dangling an ultra-high frequency antenna, C.I.A. specialists believe that the aircraft will be able to collect much of the data on missile performance previously intercepted in the northern mountains of Iran.

U-2 Plan Runs Into Obstacles

The Administration's U-2 plan, however, has run into political and technical obstacles. Under pressure from the Soviet Union, the Turkish government of Prime Minister Bulet Ecevit is having second thoughts over whether it should grant the United States overflight rights for the new versions of the U'2. And even if the Turkish government does finally give its permission for the flights, some specialists acknowledge that the aircraft's antenna will not be able to pick up the entire wave spectrum of telemetry signals.

The job of collecting the missile signals has been further exacerbated by a Soviet practice known in intelligence circles as "encryption," the transmission of telemetry in code. During a single test firing, a missile may broadcast telemetry on as many as 30 or more fre-

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